

Factors Contributing to Older Adults Living Alone and Thereby at Risk of Poor Health and Adverse Health Outcomes

Nikki Shipley, PhD, MS¹

¹University of La Verne, Department of Public and Health Administration,
La Verne, CA, USA (nshipley@laverne.edu).

Abstract

Introduction: Extensive research demonstrates that older adults living alone tend to be less healthy, have poorer health outcomes and are at greater risk of dying. While many investigators have explored various aspects of aging, there has been limited work assessing factors that increase the chances of an older adult to live alone. This study examines the association between demographic characteristics; current health status; and social, cultural, and environmental factors among older adults (65 years of age and older) and the likelihood they will live alone. **Methods:** Secondary analyses is conducted of survey data from the Americans' Changing Lives (ACL) cohort study initiated in 1986 (Wave 1) and continued through 2012, with four follow-up surveys conducted in 1989 (Wave II), 1994 (Wave III), 2001/02 (Wave IV), and 2011/12 (Wave V). All ACL participants 65 years and older at time of survey (Wave I – V) are included for this study (N=7,020). An analysis of variance (ANOVA) that included demographics, health status, and social support factors is employed to determine the relationship of these variables to an older adult reporting living alone. Additionally, the Cox proportional hazards model is used for survival analysis to predict the

expected age at onset of living alone. **Results:** Four critical factors reduce the probability of an older adult living alone: 1) marital status (married), 2) gender (male), 3) presence of at least one living child, and 4) willingness to spend time in the garden (physical activity). An older female adult who is currently single and without a living child is most likely to report living alone ($p<.001$). **Conclusions:** Older adults living alone are at higher risk of poor health and health outcomes. The influx of baby boomers, whose life expectancy is longer than the past, will cause a dramatic increase in senior adults living alone. This research suggests a guideline to public health professionals for identifying those at risk of being negatively impacted by living alone so that they can intervene and provide alternative living arrangements and support services, as necessary.

Keywords: living alone, older adults, health outcomes

Introduction

The United States is an aging society: by 2050, the total population of older adults in the United States is expected to reach 84 million, nearly doubling the older adult population of 2012 (Ortman, Velkoff, & Howard, 2014). The influx of aging baby boomers, combined with their increased life expectancy, will cause a dramatic increase in the number of older adults (65 years of age and older) (Frey, 2011). The shortage of available family caregivers and the strong desire of older adults to age in place creates a conundrum as the population of elders living alone increases. How can we reduce the negative impact of living alone? Although there is an abundance of research on aging, including the shortage of long-term care services (Edwards & Sen, 2019), financing health care (Kee-Lee & Chi, 2000), aging in place (Greenfield,

2012), and attachment to place (Wiles, 2017), few studies have identified those at risk of being negatively impacted by living alone. This study aimed to identify the factors contributing to older adults (65 years and older) living alone in the U.S.

The projected increase in the number of older adults living alone should be of concern to public health officials and health care professionals alike. As Sarah (2014) concluded, there are twenty unhealthy facts associated with living alone, ranging from physical health side-effects, such as high blood pressure, to mental health issues arising from loneliness. Additionally, older adults living alone are disproportionately impacted during catastrophic events. For example, in 1995, during the Chicago Heat Wave, more than 700 older seniors living alone died (Editorial Board, 2015). Of those who died in Hurricane Katrina, 70% were over the age of 60 (Adams, Kaufman, van Hattum, & Moody, 2011). Urban and rural areas alike have no system for identifying residents who are vulnerable and living alone, instead relying on neighbors, friends, and family who typically are not nearby to determine the well-being of the most vulnerable during disasters.

An older adult's likelihood of living alone is influenced by several factors, including their demographic characteristics; current health status; and social, cultural, and environmental factors. An individual's gender, current marital status, race, and number of living children directly influence whether they will live alone as a senior adult. For instance, older women are more likely to live alone than their male counterparts (Katz, Kabeto, & Langa, 2000; Robison & Moen, 2000). Current marital status is one of the strongest demographic

factors predicting living arrangements; at least 80% of older adults living alone have never been married or are divorced or widowed (Kee-Lee & Chi, 2000; Panigrahi, 2013; Sok & Yun, 2011). Studies looking at differences by ethnicity have found Hispanic and non-Hispanic White older adults are more likely to live alone compared to other ethnicities (Lau & Kirby, 2009; Russell, 2009), while Asian Americans are less likely to live alone (Kaida, Moyser, & Park, 2009). Researchers agree that having a surviving child, particularly one not in old age, significantly impacts an elder's living arrangements (Freedman, 1996; Himes, Wagner, Wolf, Aykan, & Dougherty, 2000). Furthermore, older adults who never had a child are twice as likely to live alone than those who had at least one (Panigrahi, 2013; Schorr, 1980).

However, research on the impact of education and income is inconclusive. Some U.S. studies have found that the higher a person's level of education, the more likely they are to live alone as an older adult (Festy & Rychtarikova, 2008; Palloni, 2001; Zueras & Gamundi, 2013). Others concluded that higher education is associated with better health and having fewer offspring; therefore, these seniors were less likely to live with one of their older children (Zueras & Gamundi, 2013). Meanwhile, global data collected by the United Nations (2005) found no relationship between education and living alone. Finally, among Americans, income impacts an older person's living arrangements (Kobrin, 1981; Schwartz, Smolensky, & Danziger, 1984; Wolf, 1984), particularly among females (Bishop, 1986). Specifically, older adults with a greater than median-level income are more likely to live alone, while those with a lower income are more likely to live with others (Bishop, 1986; Kaida et al., 2009). Globally, results from the United Nation study (2005)

indicated that a lower income increases the odds of an older adult living alone.

An older adult's health status, defined by one's current physical abilities measured either by an individual's Activities of Daily Living (ADLs) (i.e., an individual's daily self-care activities indicated by their ability to bathe, dress, eat, get outside, transfer between bed and chairs, use the toilet, and walk without assistance) or by their Instrumental Activities of Daily Living (IADLs) (i.e., the activities in ADLs and additional activities that allow an individual to live independently, including doing light housework, managing money, preparing meals, shopping for personal items, taking medications as prescribed, riding transportation, and using the telephone) in conjunction with current health conditions, has a significant effect on their ability to live alone. That is to say, older adults with better functional status are more likely to live alone. (Hui, Kun, Yifeng, Fangyuan, & He, 2013; Li-Tang et al., 2013). Accordingly, elders with significant functional impairments tend to live with others (Russell, 2009; Schwartz et al., 1984; Soldo, 1981; Wolf, 1984). Furthermore, the joint effect of income and physical impairment was investigated by Bishop (1986), who found that older adults with difficulties in ADLs or IADLs were more likely to live alone if they had enough money to do so. However, while healthier older adults are more likely to report living alone (Chou & Chi, 2000; Dean, Kolody, Wood, & Matt, 1992; Gee, 2000; Iwasa, Kawaai, Gondo, Inagaki, & Suzuki, 2006; Mui, Choi, & Monk, 1998), living with others can be beneficial for this group. Adults who live with others are more likely to have good nutrition, adhere to treatment, complete doctor's appointments, and adhere to preventative care recommendations, such as

colonoscopy or mammograms (Birkeland & Natvig, 2009; Coons et al., 1994; Lau & Kirby, 2009).

Living arrangements among older adults are influenced by their social environment comprising their cultural background, amount of social support, and extent of social isolation. Different cultural values produce different intentions for living arrangements among older adults (Kaida et al., 2009). Most developed countries encourage their older population to live independently with limited or no assistance from their children (Gaymu et al., 2006; Rolls, Seymour, Froggett, & Hanratty, 2011). In contrast, families in developing countries value their elders and are honored to support and care for them; their older adults' well-being is a core value of their culture (Asis, Domingo, Knodel, & Mehta, 1995). Still, many older adults living alone find their social interactions (social support) and activities restricted, putting them at risk of social isolation (Alwin, Converse, & Martin, 1985). Inadequate social support places an older adult at greatest risk of dying alone, particularly for those living alone. For instance, Berkman and Syme (1979) found that the most isolated adults in the Alameda County longitudinal study with the least amount of social contacts were more than two times more likely to die (men were 2.3 and women were 2.8) during the nine-year follow-up.

It is important to note that the majority of the research referenced above was conducted twenty to thirty years ago, with an entirely different population than that of today's aging population of baby boomers. This group remains mobile, has had fewer children, has continued working into much later years, and is more independent than past aging generations. Many seniors hold

feelings of attachment to place which becomes stronger with age and has been shown to have a positive relationship with health (Wiles, 2017). Therefore, as this population increases, it is a critical public health matter to determine who is most likely to live alone so as to reduce the potential impact on their health by providing tailored and efficacious preventive interventions, such as alternative living arrangements and support services. The following hypothesis was tested: an older adult's demographic characteristics, current health status, and social environment are associated with living alone.

Methods

This study employed secondary analysis of data collected from the Americans' Changing Lives (ACL) national longitudinal study initiated in 1986 and comprising adults 25 years and older in the continental U.S. It is one of the oldest ongoing nationally representative studies that includes a broad range of social, psychological, and behavioral factors, along with medical care, environmental exposure, and other aspects of health. Face-to-face follow-up surveys were conducted in 1989 (Wave II), 1994 (Wave III), 2001/02 (Wave IV), and 2011/12 (Wave V). Secondary analysis of large public use data such as the ACL is a very cost-effective strategy that can be used to create assessments and evaluations, identify key elements for planning interventions, and test hypotheses. These datasets may include medical and pharmaceutical insurance claims at a statewide or regional level.

All participants 65 years and older at the time of the survey (Waves I – V) were selected for this study (N=7,020). To test the differences between age

groups, the sample was divided into two subgroups within each Wave: Group 1 (Younger-Old), comprised of participants between 65 and 74 years of age at time of survey ($n_1=4,785$), and Group 2 (Older-Old), comprised of participants 75 years of age and older at time of survey ($n_2=2,235$). Questions (see Table 1) concerning demographics, health status, and social support were independent variables used to conduct an analysis of variance (ANOVA) to determine factors contributing to an older adult reporting living alone (dependent variable). Additionally, the Cox proportional hazards model was used to conduct survival analysis to predict the age at onset of living alone.

**Table 1. List of Questions from Americans' Changing Lives
Used to Conduct Secondary Analyses**

SURVEY QUESTION	VARIABLE NAME	ORIGINAL CODES
Before we start the interview, I need to relist the people who live here. I need the age, sex and relationship to respondent.	Gender: SEX Of 1st Respondent AOB1(1)	1 = Male 2 = Female
Before we start the interview, I need to relist the people who live here. I need the age, sex and relationship to respondent.	AGE OF 1st Respondent AOC1(1):	CONTINUOUS
Are you currently married, separated, divorced, widowed or have you never been married?	V4401	1 = Married 2 = Separate 3 = Divorced 4 = Widowed 5 = Never married
Variables below this line were collapsed into fewer categories		
Are you white, black, American Indian, Asian, or another race?	RACE/ETHNICITY R1:HISPANIC DESCENT V1620	0 = Not Spanish/ Hispanic...(V1621) 1 = Mexican 2 = Mexican American 3 = Chicano 4 = Puerto Rican 5 = Cuban 6 = Central American/South American 7 = Spanish/Castilian/Spanish American 97 = Other Spanish
What is the highest grade of school or year of college you have completed?	R13:EDUC-HIGHEST YEAR Education grade	CONTINUOUS

SURVEY QUESTION	VARIABLE NAME	ORIGINAL CODES
HEALTH		
How would you rate (his/her) health at the present time?	"PR-Self Rated Health"	1 = excellent 2 = very good 3 = good 4 = fair or poor 5 = not good
PHYSICAL ACTIVITIES		
Please tell me how often you typically work in the garden or yard	V223: A5A	1 = often 2 = sometime 3 = rarely 4 = never
SOCIAL SUPPORT		
In a typical week, about how many times do you talk on the telephone with friends, neighbors or relatives?	V220: A2:	4 = 1 time/week 5 = <1 time/week 6 = Never
How often do you get together with friends, neighbors or relatives and do things like go out together or visit in each other's homes?	V221: A3	1 = Less than 1 time/WK 2 = 1 time/week 3 = 2-3 times/Month 4 = 1 time/Month 5 = Less than 1 time/Month 6 = NEVER
Variables below this line were combined as a score then recoded into categories for AT LEAST ONE CHILD LIVING		
How many grandchildren do you have, if any?	A1C:	0 = None 1 = 1 2 = 2...
Interviewer checkpoint questions. Responder has no children 16+	C13:	1 = No child 2 = Child <16 3 = 1 child 16+ 4 = 2+Age16+
Have you ever had a child who died?	V440: C23	1 = Yes 5 = No
Variables below this line were combined into a score and then coded into categories for POVERTY		
In order to get an accurate picture of your (and your spouse's) income, it helps to know the different sources of income you (and your spouse) may have had during the past 12 months. We do not need detailed amounts, just whether you (and your spouse) have any income from the sources I will mention.	R26B:SOCIAL SEC INCOME	1 = Yes 5 = No

SURVEY QUESTION	VARIABLE NAME	ORIGINAL CODES
In order to get an accurate picture of your (and your spouse's) income, it helps to know the different sources of income you (and your spouse) may have had during the past 12 months. We do not need detailed amounts, just whether you (and your spouse) have any income from the sources I will mention.	R26F:SSI INCOME	1 = Yes 5 = No
Income—SSI In order to get an accurate picture of your (and your spouse's) income, it helps to know the different sources of income you (and your spouse) may have had during the past 12 months. We do not need detailed amounts, just whether you (and your spouse) have any income from the sources I will mention.	R26H:FOOD STAMPS	1 = Yes 5 = No
Income—Food Stamp In order to get an accurate picture of your (and your spouse's) income, it helps to know the different sources of income you (and your spouse) may have had during the past 12 months. We do not need detailed amounts, just whether you (and your spouse) have any income from the sources I will mention.	R28: INCOME R RECEIVED	1 = <\$5000 2 = \$5-9K 3 = \$10-14K 4 = \$15-19K 5 = \$20-24K 6 = \$25-29K 7 = \$30-39K 8 = \$40-59K 9 = \$60-79K 10 = \$80000+

Results

Tables 2 and 3 describe the demographic distribution by Wave for Group 1 and 2, respectively. The majority of both groups, almost 70%, were female. The distribution of race/ethnicity was clear: 72% of surveyed participants were non-Hispanic Whites and 26.7% were Black or African American. There was a gradual decline in the proportion reporting less than a high school graduation coinciding with an increase in high school graduates over Waves (time). The majority of surveyed participants were either married or widowed (~88%).

Table 2. Group 1: Demographics by Wave

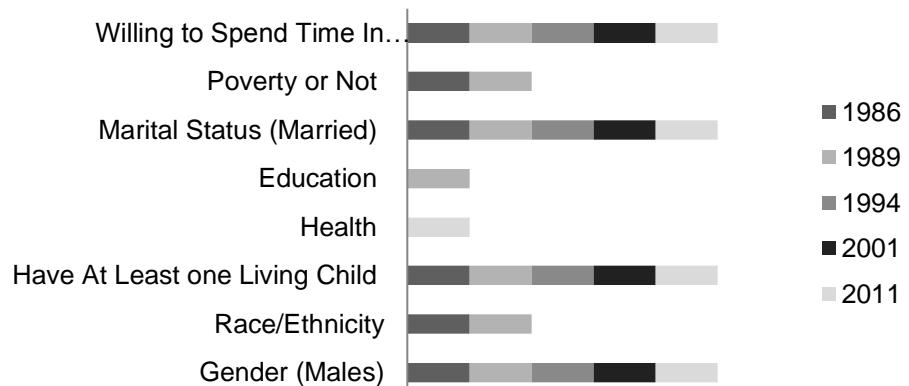
	Baseline Wave I 1986	Follow-up 1 Wave II - 1989	Follow-up 2 Wave III 1994	Follow-up 3 Wave IV - 2001	Follow-up 4 Wave V - 2011	Total Group 1 Study Sample
GENDER						
Male	31.0% (375)	30.0% (334)	30.3% (329)	29.4% (214)	33.4% (216)	30.7% (1468)
Female	69.0% (833)	70.0% (781)	69.7% (758)	70.6% (515)	66.6% (430)	69.3% (3317)
RACE/ETHNICITY						
Black	29.3% (354)	28.2% (314)	26.9% (292)	22.5% (164)	26.0% (168)	26.7% (1292)
White	69.7% (842)	71.2% (794)	72.2% (785)	76.5% (558)	72.3% (467)	72.0% (3446)
AGE						
Mean Age	72 Yrs. of Age	72 Yrs of Age	74 Yrs of Age	77 Yrs of Age	76 Yrs of Age	73 Yrs of Age
65-69	35.8% (433)	33.7% (376)	22.6% (246)	14.7% (107)	27.2% (176)	28.2% (1338)
70-74	28.3% (341)	26.8% (298)	29.4% (319)	18.2% (133)	18.8% (121)	25.6% (1212)
75-79	19.3% (233)	19.7% (219)	22.8% (248)	30.1% (219)	13.6% (88)	21.2% (1007)
80-84	10.8% (129)	9.3% (78)	11.4% (160)	15.0% (157)	12.5% (81)	12.8% (605)
85+	6.0% (72)	7.3% (99)	10.5% (114)	12.5% (113)	27.3% (180)	12.2% (578)
LAST GRADE COMPLETED						
< High School	56.0% (676)	50.0% (558)	44.6% (485)	34.0% (248)	24.8% (160)	44.9% (2127)
High School Grad	22.5% (272)	24.9% (278)	27.4% (298)	34.3% (250)	34.8% (225)	27.9% (1323)
College Grad	17.1% (206)	18.8% (210)	21.9% (238)	24.6% (179)	30.2% (195)	21.7% (1028)
Post College	3.7% (45)	4.4% (49)	4.9% (53)	6.6% (48)	9.4% (61)	5.4% (256)
MARITAL STATUS						
Married	45.4% (548)	45.6% (508)	45.2% (491)	41.2% (300)	42.4% (274)	44.3% (2121)
Separated	2.2% (27)	1.4% (16)	1.3% (14)	1.5% (11)	0.8% (5)	1.5% (73)
Divorced (Wave 4&5)	6.4% (77)	6.5% (72)	6.4% (70)	8.4% (61)	12.1% (78)	7.5% (358)
Widowed	41.6% (502)	43.0% (479)	43.6% (474)	45.4% (331)	39.3% (254)	42.6% (2040)
Never Married	4.5% (54)	3.6% (40)	3.5% (38)	3.6% (26)	5.4% (35)	4.1% (193)

Table 3. Group 2: Demographics by Wave

	Baseline Wave I 1986	Follow-up 1 Wave II 1989	Follow-up 2 Wave III 1994	Follow-up 3 Wave IV 2001	Follow-up 4 Wave V 2011	Total Group 3 Study Sample
GENDER						
Male	31.8% (138)	27.4% (121)	23.6% (124)	27.8% (136)	29.5% (103)	27.9% (622)
Female	68.2% (296)	72.6% (320)	76.4% (398)	72.2% (353)	70.5% (246)	72.1% (1613)
Race/Ethnicity						
Black	27.4% (119)	27.8% (122)	27.4% (143)	18.8% (92)	24.6% (86)	24.8% (562)
White	70.5% (306)	72.0% (317)	72.2% (377)	80.0% (391)	74.5% (260)	74.0% (1651)
AGE						
Mean Age	79 Yrs of Age	80 Yrs of Age	80 Yrs of Age	80 Yrs of Age	85 Yrs of Age	80 Yrs of Age
75-79	53.7% (233)	49.8% (219)	47.5% (248)	44.8% (219)	25.2% (88)	45.1% (1007)
80-84	29.7% (129)	31.8% (140)	30.7% (160)	32.1% (157)	23.2% (81)	29.9% (667)
85+	12.7% (72)	19.4% (81)	21.8% (114)	23.1% (113)	51.6% (180)	25.0% (560)
LAST GRADE COMPLETED						
< High School	60.8% (264)	57.3% (252)	50.8% (264)	34.4% (167)	29.2% (102)	47.0% (1049)
High School Grad	18.9% (82)	20.0% (88)	23.9% (125)	34.9% (161)	35.5% (124)	26.0% (580)
College Degree	16.1% (70)	16.1% (71)	20.3% (105)	26.6% (130)	25.5% (89)	20.9% (465)
Post College	3.2% (14)	4.1% (18)	4.0% (53)	5.5% (27)	8.3% (29)	6.3% (141)
MARITAL STATUS						
Married	33.2% (144)	33.3% (146)	32.4% (169)	36.0% (176)	30.1% (105)	33.2% (740)
Separated	1.6% (7)	0.7% (3)	0.8% (4)	1.0% (5)	1.1% (4)	1.0% (23)
Divorced (Wave 4&5)	3.7% (16)	3.8% (17)	3.6% (19)	5.7% (28)	9.7% (34)	5.1% (114)
Widowed	56.2% (244)	58.4% (257)	60.3% (315)	54.2% (265)	55.6% (192)	57.0% (1273)
Never Married	5.3% (23)	3.9% (17)	2.9% (15)	3.1% (15)	3.4% (12)	3.7% (82)

Results of the ANOVA test indicated several factors contributing to older adults living alone. Figure 1 lists the protective factors preventing older adults from living alone from Wave I to Wave V. Among Group 1 (Younger-Old), there were four critical factors that were found to reduce the probability of living alone: 1) marital status (married), 2) gender (male), 3) having at least one living child, and 4) willingness to spend time in the garden (used in this analysis as an indicator of physical activity, or health status). Poverty and race/ethnicity were two important factors in Wave I and Wave II (1986 through 1989); however, they were not significantly related to older adults living alone during Waves III to V (1994 through 2011). Furthermore, results showed that an older woman who was currently single (separated, divorced/marriage annulled/widowed, or never married), did not have a living child, and did not spend time in the garden is most likely to live alone.

Figure 1. Group 1 - Protective Factors That Reduce the Risk of Living Alone by Wave



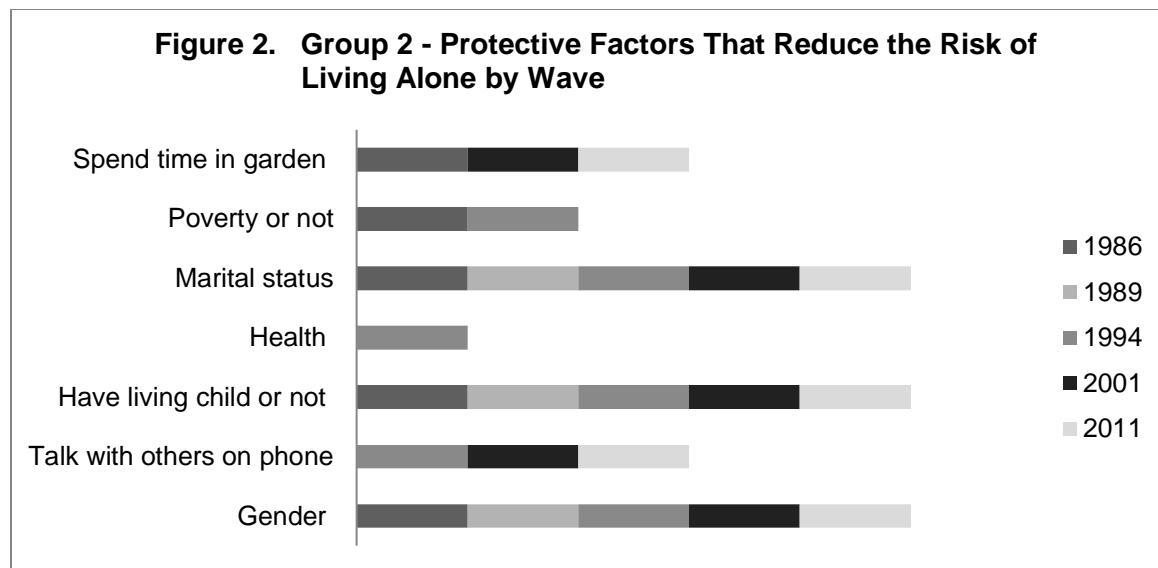


Figure 2 shows three critical protective factors that prevented older adults in Group 2 (Older-Old) from living alone during Waves I to V: 1) marital status (married), 2) gender (male), and 3) having at least one living child. Spending time in the garden, a factor that had an influence on Group 1, was not significantly related to Group 2 in Wave II and Wave III, while living in poverty only played a role in Wave I and Wave III. Furthermore, there was an additional factor affecting Group 2 that was not found in Group 1: frequency of talking with friends or family on the phone. In Waves III to V, the more frequently an older adult spent talking on the phone with friends or family, the stronger the likelihood of living alone. Based on these findings, an older woman who was single (separated, divorced/marriage annulled/widowed, or never married), did not have a living child, and talked with friends or family frequently on the phone was more likely to live alone.

Results of the survival analysis (see Table 4 for Group 1 and Table 5 for Group 2) identified the age an older adult is expected to report living alone

within each Wave. Group 1 males begin living alone about two years after their female counterparts. Furthermore, a single adult (separated, divorced/marriage annulled/widowed or never married) has a substantially younger onset of living alone than any other factor in both Groups and throughout all Waves. This is followed by the factors of “living without a child” and “widowed,” regardless of Wave.

Table 4. Group 1: Expected Age of Living Alone by Wave

RISK FACTORS	Baseline Wave I Expected Age 1986	Follow-up 1 Wave II Expected Age 1989	Follow-up 2 Wave III Expected Age 1994	Follow-up 3 Wave IV Expected Age 2001	Follow-up 4 Wave V Expected Age 2011
Male	81.3***	82.7***	84.0***	85.6***	87.3***
Female	79.2***	79.7***	82.4***	83.2***	85.7***
With At Least 1 Living Child	80.5**	80.8**	83.3**	84.1**	86.8***
No Living Child	77.6**	79.0**	80.8**	81.5**	80.3***
Married	91.2***	90.4***	89.2***	93.3***	91.7***
Separated	73.5***	73.4***	72.9***	77.7***	78.8***
Divorced/Annulled	73.1***	73.5***	75.5***	76.3***	80.1***
Widowed	77.7***	78.5***	81.1***	82.4***	86.1***
Never Married	75.2***	76.7***	77.2***	75.7***	75.8***
Some Time In Garden	79.0*	79.6	80.7	82.3	83.9
Seldom Time In Garden	80.4*	81.0	81.9	83.0	84.3

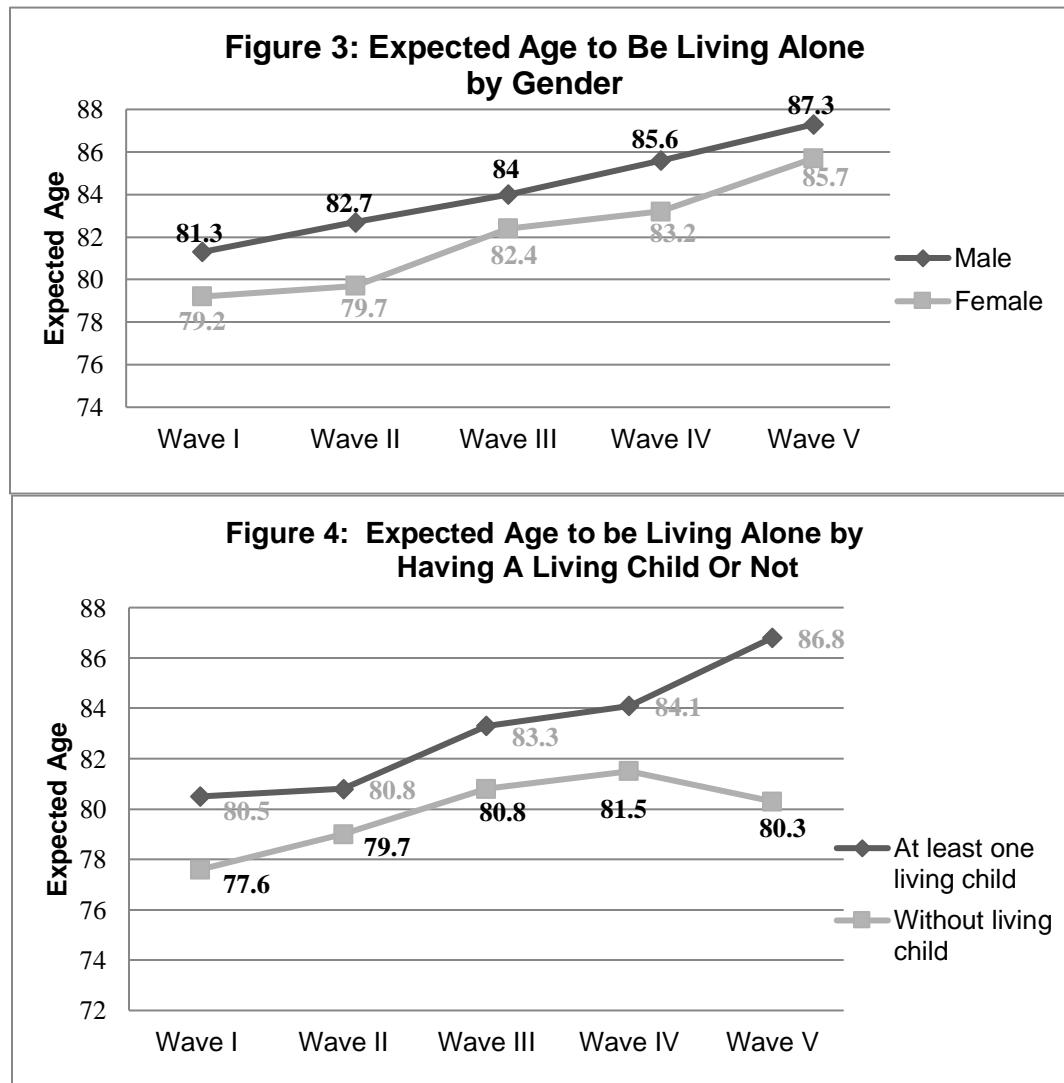
(*P<.05; **P<.01; ***P<.001)

Table 5. Group 2: Expected Age of Living Alone by Wave

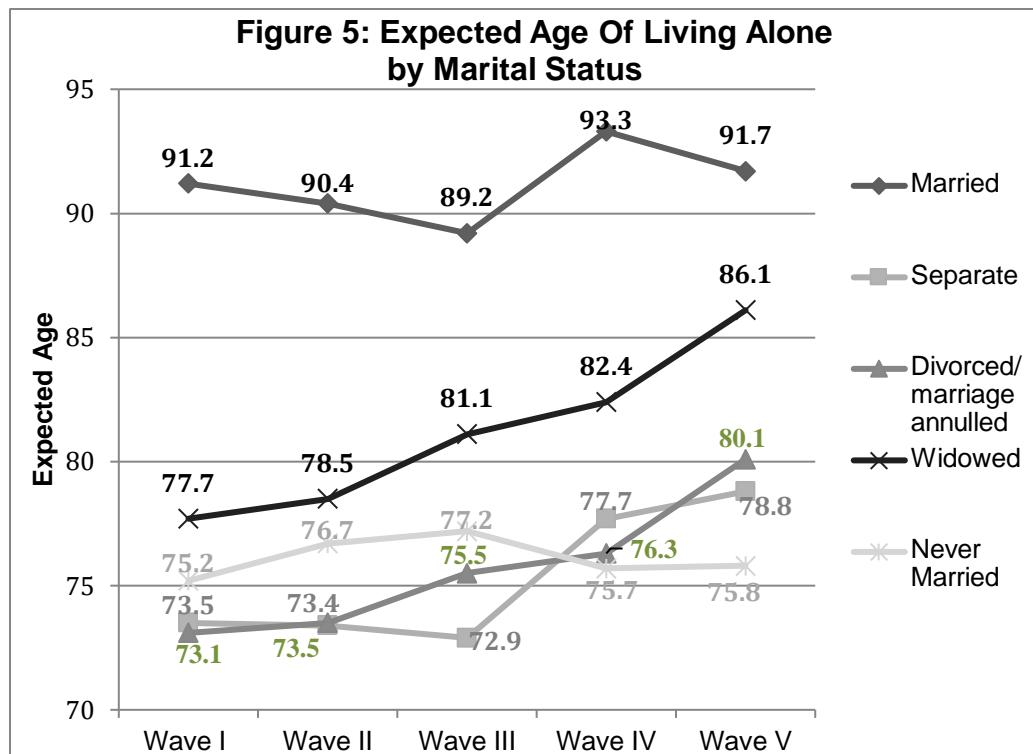
RISK FACTORS	Baseline Wave I Expected Age 1986	Follow-up 1 Wave II Expected Age 1989	Follow-up 2 Wave III Expected Age 1994	Follow-up 3 Wave IV Expected Age 2001	Follow-up 4 Wave V Expected Age 2011
Male	84.9**	85.7***	86.2*	86.9*	89.4*
Female	83.0**	83.2***	85.2*	85.3*	88.7*
At Least 1 Living Child	84.4**	84.3*	85.9	86.1*	89.1*
No Living Child	81.4**	82.5*	84.5	83.6*	87.7*
Married	91.3***	90.4***	89.3***	93.3***	91.8***
Separated	78.0***	73.4***	75.7***	80.4***	80.8***
Divorced/Annulled	80.5***	73.5***	81.1***	81.8***	86.5***
Widowed	82.6***	78.5***	84.2***	84.4***	88.4***
Never Married	79.1***	76.7***	84.2***	78.3***	84.8***

(*P<.05; **P<.01; ***P<.001)

As Figure 3 below illustrates, this age gap is persistent throughout the total study sample. Additionally, having at least one living child remains protective against living alone until later years, as shown in Tables 4 and 5. Below, Figure 4 displays that among the entire study sample, an individual with no living child is expected to report living alone at a significantly younger age (77.6 years of age) than a person with at least one living child (80.5).



Married older adults do not live alone until about 90 years of age, which is significantly later than currently single adults, who begin living alone between 75 and 80 years of age (Figure 5).



Finally, the difference in expected age of living alone as determined by spending time in the garden was less than a year. This was consistent with the ANOVA results which found no statistical significance between spending time in the garden and an older adult's living arrangement.

Discussion

The aim of this study was to examine the contribution of demographic characteristics; current health status; and social, cultural, and environmental factors to older adults' living arrangements. Results indicated that marital status, gender, and having at least one living child were the three common factors contributing to all older adults living alone irrespective of Group (age) or Wave. It was difficult to confirm if income, education, and health conditions contributed to older adults living alone. The data analysis revealed that these

factors were only critical in one Wave or one age Group, which meant that these factors might affect elders' living arrangements under specific conditions. Following these results, we reject the null hypothesis and partially accept the hypothesis that an older adult's demographic characteristics (marital status and gender), current health status (working in the garden), and social environment (having a child) are associated with living alone.

Marital status was the most critical factor causing an older individual to live alone regardless of gender. This is consistent with past research that reported marital status as the strongest predictor of living alone. However, results of other demographic characteristics were not so clear. Poverty and race/ethnicity were only critical to Group 1 in the earlier Waves (I and II). Meanwhile, poverty and willingness to spend time in the garden were important factors for Group 2 within all Waves, as was frequency of talking with friends or family on the phone for Waves III, IV, and V. Married older adults delay living alone until they are between 89 and 93 years of age, while the currently single older adults are expected to live alone at a significantly earlier age (80 years). This implies that the chances of a married older adult ever living alone are very low. Also, female older adults are more likely to live alone than their male counterparts in both age Groups (Group 1 $p<.001$ and Group 2 $p<.01$). Women choose to live alone about two to three years earlier than men. This can be explained by women tending to live longer than their male partners and being less likely to remarry after a death, divorce, or separation. This may be explained by the reduction in the older adult male population; at age 85 and older, women outnumbered men by a ratio of 2-to-1 (4.0 million to 2.0 million) (U.S. Census Bureau, 2013).

Additionally, having at least one living child was a statistically significant risk factor contributing to an elder's living arrangement (Group 1 $p<.001$ and Group 2 $p<.01$). Older adults who had at least one living child reported living alone 3-4 years later than those who did not have a living child. In fact, this is consistent with the growth of intergenerational housing that accommodates three generations (grandparents, parents, and children) under one structure. However, the older population's health conditions (working in the garden) and education levels were not critical factors contributing to living alone, while poverty and talking on the telephone were significant only in the later Waves. Based on this analysis, ethnicity was no longer a factor after 1990.

Study Limitations

When interpreting these results, one must be cognizant of several limitations of this study that are typical with secondary analyses. The survey questions were designed and coded by the original researchers. Proxy measures (questions) were used when actual questions did not exist in the survey. For instance, "frequency of gardening" was used as an indicator of health status (i.e., activity) and "talking on the phone with others" represented social support. Moreover, some factors known to influence an older adult's decision in living arrangements were omitted from this study, including language spoken at home, cultural background, and specific physical activity levels (i.e., ADLs and IADLs) due to their absence in the original survey. Other limitations of these data include the response rates of the follow-up surveys (Waves II to V), which were significantly reduced over the years (45% for

Waves IV and V in Group 1 and 23% for Wave V in Group 2). These lower response rates could have affected the diversity of the original sample and biased the study group. Finally, there was concern about the validity and reliability of the measurement tool between Waves. Although the same coding protocols were employed across waves, the wording of some of the questions were inconsistent from Wave to Wave, which could reduce the accuracy of the analysis. Nevertheless, the sample size of this cohort (N=7,020) collected over a span of 23 years and the importance of knowing more about the growing population of older adults living alone make this study's results significant to the public health research community.

Implications

The proportion of the growing population of baby boomers expected to live alone in their later years is of national, state, and local concern. We live in a time when natural disasters are occurring at record numbers; during catastrophic events, older adults living alone are at an increased risk of death or physical injury. Results of this study indicate that many of these older adults will be single, without adult children or an extended group offering social support. To prevent the repercussions of living alone, such as poorer health status, health outcomes, and dying alone, it is imperative that prevention and intervention opportunities be developed and embedded in the infrastructure of state and local (County/City) Departments of Public Health.

Conclusion

This study concluded that gender, marital status, and having at least one living child have a significant impact on an older adult reporting living alone. Specifically, an older female adult who was currently single and without a

living child was at increased risk of living alone ($p<.001$). To further investigate risk factors contributing to older adults living alone and thereby impacting their health, it is recommended that future research on this topic use primary data that closely examines the impact of culture, language, and social support along with primary health care information in conjunction with the factors identified in this study.

Conflict of Interest to Declare

The authors have no conflicts of interest to disclose.

Statement of Funding

This study was not supported by any funding.

References

Adams, V., Kaufman, S. R., van Hattum, T., & Moody, S. (2011). Aging disaster: Mortality, vulnerability, and long-term recovery among Katrina survivors. *Medical Anthropology*, 30(3), 247–270.
[doi:10.1080/01459740.2011.560777](https://doi.org/10.1080/01459740.2011.560777)

Alwin, D. F., Converse, P. E., & Martin, S. S. (1985). Living arrangements and social integration. *Journal of Marriage and the Family*, 319-334.
<https://doi.org/10.2307/352132>

Asis, M. M. B., Domingo, L., Knodel, J., & Mehta, K. (1995). Living arrangements in four Asian countries: A comparative perspective. *Journal of Cross-Cultural Gerontology*, 10(1-2), 145-162.
<https://doi.org/10.1007/BF00972034>

Berkman, L. F., & Syme, S. L. (1979). Social networks, host resistance, and mortality: a nine-year follow-up study of Alameda County residents. *American Journal of Epidemiology*, 109(2), 186–204.
<https://doi.org/10.1093/oxfordjournals.aje.a112674>

Birkeland, A., & Natvig, G. K. (2009). Coping with ageing and failing health: A qualitative study among elderly living alone. *International Journal of Nursing Practice*, 15(4), 257-264. <https://doi:10.1111/j.1440-172X.2009.01754.x>

Bishop, C. E. (1986). Living arrangement choices of elderly singles: Effects of income and disability. *Health Care Financing Review*, 7(3), 65-73.

Chou, K. L., & Chi, I. (2000). Comparison between elderly Chinese living alone and those living with others. *Journal of Gerontological Social Work*, 33(4), 51-66. https://doi.org/10.1300/J083v33n04_05

Coons, S. J., Sheahan, S. L., Martin, S. S., Hendricks, J., Robbins, C. A., & Johnson, J. A. (1994). Predictors of medication noncompliance in a sample of older adults. *Clinical Therapeutics*, 16, 110-117.

Dean, A., Kolody, B., Wood, P., & Matt, G. E. (1992). The influence of living alone on depression in elderly persons. *Journal of Aging and Health*, 4(1), 3-18. <https://doi:10.1177/089826439200400101>

Editorial Board. (2015, July 5). Forgotten souls: Chicago's killer heat wave of 1995. *The Chicago Tribune*, Editorial Section.

Edwards, B. C., & Sen, A. P. (2019). High demand and fragmentation: The current state of long-term services and supports in America. *Generations*, 43(1), 20–24.

Festy, P., & Rychtarikova, J. (2008). Living conditions for the elderly in the late twentieth century. *Future Elderly Living Conditions in Europe*. Paris: INED.

Freedman, V. A. (1996). Family structure and the risk of nursing home admission. *Journal of Gerontology: Social Sciences*, 2, 61–69. <https://doi.org/10.1093/geronb/51B.2.S61>

Frey, W. (2011). The uneven aging and “younging” of America: State and metropolitan trends in the 2010 census. *The Brookings Institution, Metropolitan Policy Program*.

Gaymu, J., Delbès, C., Springer, S., Binet, A., Désesquelles, A., Kalogirou, S., & Ziegler, U. (2006). Determinants of the living arrangements of

older people in Europe. *European Journal of Population*, 22(3), 241-262. <https://doi:10.1007/s10680-006-9004-7>

Gee, E. M. (2000). Living arrangements and quality of life among Chinese Canadian elders. *Social Indicators Research*, 51(3), 309-329. <https://doi.org/10.1023/A:100703612>

Greenfield, E. (2012). Using ecological frameworks to advance a field of research, practice, and policy on aging-in-place initiatives. *The Gerontologist*, 52(1), 1-12. <https://doi.org/10.1093/geront/gnr108>

Himes, C. L., Wagner, G. G., Wolf, D. A., Aykan, H., & Dougherty, D. D. (2000). Nursing home entry in Germany and the United States. *Journal of Cross-Cultural Gerontology*, 15, 99-118. <https://doi.org/10.1023/A:1006797731500>

Hui, W., Kun, C., Yifeng, P., Fangyuan, J., & He, L. (2013). Associations and impact factors between living arrangements and functional disability among older Chinese adults. *Plos ONE*, 8(1), 1-7. <https://doi:10.1371/journal.pone.0053879>.

Iwasa, H., Kawai, C., Gondo, Y., Inagaki, H., & Suzuki, T. (2006). Subjective well-being as a predictor of all-cause mortality among middle-aged and elderly people living in an urban Japanese community: A seven-year prospective cohort study. *Geriatrics & Gerontology International*, 6(4), 216-222. <https://doi.org/10.1111/j.1447-0594.2006.00351.x>

Kaida, L., Moyser, M., & Park, S. Y. (2009). Cultural preferences and economic constraints: The living arrangements of elderly Canadians. *Canadian Journal on Aging*, 28(4), 303-313. <https://doi.org/10.1017/S0714980809990146>

Katz, S. J., Kabeto, M., & Langa, K. M. (2000). Gender disparities in the receipt of home care for elderly people with disability in the United States. *Journal of the American Medical Association*, 284, 3022-3027. <https://doi:10.1001/jama.284.23.3022>

Kee-Lee, C., & Chi, I. (2000). Comparison between elderly Chinese living alone and those living with others. *Journal of Gerontological Social Work*, 33(4), 51-66. https://doi.org/10.1300/J083v33n04_05

Kobrin, F. E. (1981). Family extension and the elderly: Economic, demographic, and family cycle factors. *Journal of Gerontology*, 36(3), 370-377. <https://doi.org/10.1093/geronj/36.3.370>

Lau, D. T., & Kirby, J. B. (2009). The relationship between living arrangement and preventive care use among community-dwelling elderly persons. *American Journal of Public Health*, 99(7), 1315-1321. <https://doi.org/10.2105/AJPH.2008.151142>

Li-Tang, T., Rantakokko, M., Portegijs, E., Viljanen, A., Saajanaho, M., Eronen, J., & Rantanen, T. (2013). Environmental mobility barriers and walking for errands among older people who live alone vs. with others. *BMC Public Health*, 13(1), 1-16. <https://doi:10.1186/1471-2458-13-1054>

Logan, J. R., & Spitz, G. D. (1995). Self-interest and altruism in intergenerational relations. *Demography*, 32, 353-364. <https://doi.org/10.2307/2061685>

Mui, A. C., Choi, N. G., & Monk, A. (1998). *Long-term care and ethnicity*. Greenwood Publishing Group.

Ortman, J. M., Victoria, A. V., & Howard, H. (2014). An aging nation: The older population in the United States. *Current Population Reports*, 25-1140.

Panigrahi, A. K. (2013). Living arrangements of elderly in India: A comparative study of Uttar Pradesh and Kerala. *Indian Journal of Gerontology*, 27(3), 495-518.

Robison, J. T., & Moen, P. (2000). A life-course perspective on housing expectations and shifts in late midlife. *Research on Aging*, 22, 499-532. <https://psycnet.apa.org/doi/10.1177/0164027500225003>

Rolls, L., Seymour, J. E., Froggatt, K. A., & Hanratty, B. (2011). Older people living alone at the end of life in the UK: Research and policy challenges. *Palliative Medicine*, 25(6), 650-657.

Russell, D. (2009). Living arrangements, social integration, and loneliness in later life: The case of physical disability. *Journal of Health & Social Behavior*, 50(4), 460-475.

Sarah, S. (2014). 20 Facts about senior isolation that will stun you. *Senior Living Blog*. Retrieved from <https://www.aplaceformom.com/blog/10-17-14-facts-about-senior-isolation/>

Schwartz, S., Smolensky, E., & Danziger, S. (1984). *The choice of living arrangements by the elderly*. University of Wisconsin--Madison, Institute for Research on Poverty.

Seeman, T. E., Kaplan, G. A., Knudsen, L., Cohen, R., & Guralnik, J. (1987). Social network ties and mortality among the elderly in the Alameda County study. *American Journal of Epidemiology*, 126(4), 714–723. <https://doi.org/10.1093/oxfordjournals.aje.a114711>

Sok, S. R., & Yun, E. K. (2011). A comparison of physical health status, self-esteem, family support and health-promoting behaviours between aged living alone and living with family in Korea. *Journal of Clinical Nursing*, 20(11/12), 1606-1612. <https://doi:10.1111/j.1365-2702.2010.03551.x>.

Soldo, B. J. (1981). The living arrangements of the elderly in the near future. *Aging: Social Change*.

U.S. Census Bureau. (2013) *America's families and living arrangements: 2012*. Retrieved from: <https://www.census.gov/prod/2013pubs/p20-570.pdf>.

United Nations. (2005). *Living arrangements of older persons around the world*. New York, NY: United Nations, Population Division, Department of Economic and Social Affairs.

Wiles, J. L., Rolleston, A., Pillai, A., Broad, J., Teh, R., Gott, M., & Kerse, N. (2017). Attachment to place in advanced age: A study of the LiLACS NZ cohort. *Social Science & Medicine*, 185, 27–37. <https://doi.org/10.1016/j.socscimed.2017.05.006>

Wolf, D. A. (1984). Kin availability and the living arrangements of older women. *Social Science Research*, 13(1), 72-89. [https://doi.org/10.1016/0049-089X\(84\)90005-X](https://doi.org/10.1016/0049-089X(84)90005-X)

Zuera, P., & Gamundi, P. M. (2013). Elderly who live alone: An overview based on the 1991 and 2001 censuses. *Revista Española de Investigaciones Sociológicas*, 144, 139-152. <https://doi:10.5477/cis/reis.144.139>

